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Abstract

THE INDUSTRIAL PRODUCTION OF FUEL ELEMENTS

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The authors deal successively with the industrial production of fuel elements for power reactors of the natural uranium-graphite-gas type, and more particularly for the EDF power stations, and with the industrial production of fuel elements containing enriched uranium designed for swimming-pool type reactors.

1st part : advanced fuel elements for the EDF reactors.

After recalling the characteristics of the fuel elements now being produced industrially for the MARCOULE and CHINON reactors, the authors give the various steps leading to the industrial production of a new type of fuel element both as concerns the can, and in certain cases the graphite sleeve, and the fuel itself.

As for as the production of the fuel is concerned, they describe the various operations, stressing the original aspects of the production and of the equipment such as :

- casting in hot moulds
- thermal treatments of Uranium containing 1% in weight molybdenum

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- welding of the pellets for closing the tubes of uranium
- canning
- controls in the various steps.

As far as can production is concerned they show why the extruded can was replaced by a machined can and give a few characteristics of the equipment used as well as the controls effected. They give also some details concerning the production and machining of the sleeves.

After recalling the state of the nuclear fuel industry in France in mid-1964, the authors stress the economic aspects of the production of fuel elements.

They show the relative importance of capital costs on the cost price of the fuel itself and examine the various items involved. They analyse the cost price of a completed fuel element using present date

In conclusion the authors show the particular points which should be the subject of future efforts in order to decrease the cost of a production which is perhaps delicate but now will defined, and review the development of this new industrial branch.

2nd part : industrial production of fuel elements for swimming-pool type reactors.

The authors show how the problem of the industrial production of rolled fuel elements has been solved in France, and give the three steps involved :

1 - Assembly of the plates made in the U. S. A.

2 - Rolling of the cores made in the U. S. A. to obtain the plates.

3 - Fabrication of the U-Al alloy and production of the cores.

They then recall briefly the characteristics of the different fuel elements now in production.

A description is given of the various stages of the production including information about the equipment ; stress is laid on the extent of the controls carried out at each stage.

In conclusion the authors consider the future development of this type of production taking into account the improvements planned and those which are possible.